



## Segment Routing—IS-IS v4 node SID

The Segment Routing—IS-IS v4 node SID feature provides support for segment routing on Cisco Intermediate System-to-Intermediate System (IS-IS) networks.

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## Information About Segment Routing IS-IS v4 Node SID

### Segment Routing IS-IS v4 Node SID

Segment Routing relies on a small number of extensions to Cisco Intermediate System-to-Intermediate System (IS-IS) and Open Shortest Path First (OSPF) protocols. There are two levels of configuration required to enable segment routing for a routing protocol instance. The top level segment routing configuration which is managed by segment routing infrastructure component enables segment routing, whereas, segment routing configuration at the router level enables segment routing for a specific address-family of a routing protocol instance. There are three segment routing states:

- SR\_NOT\_CONFIGURED
- SR\_DISABLED
- SR\_ENABLED

Segment routing configuration under the IGP is allowed only if the SR state is either SR\_DISABLED or SR\_ENABLED. The SR\_ENABLED state indicates that there is at least a valid SRGB range reserved through the MFI successfully. You can enable segment routing for IGP under the router configuration sub mode, through commands. However, IGP segment routing are enabled only after the global SR is configured.



**Note** IS-IS protocol SR command is based on per topology (IPv4 address family).

The SR\_ENABLED is a necessary state for any protocol to enable SR, however, it is not a sufficient for enabling SR for a protocol instance. The reason being that the IS-IS still does not have any information about

segment routing global block (SRGB) information. When the request to receive information about the SRGB is processed successfully, the IS-IS SR operational state is enabled.

Segment Routing requires each router to advertise its segment routing data-plane capability and the range of MPLS label values that are used for segment routing in the case where global SIDs are allocated. Data-plane capabilities and label ranges are advertised using the SR-capabilities sub-TLV inserted into the IS-IS Router Capability TLV-242 that is defined in RFC4971.

ISIS SR-capabilities sub TLV includes all reserved SRGB ranges. However, the Cisco implementation supports only one SRGB range. The supported IPv4 prefix-SID sub TLV are TLV-135 and TLV-235.

# How to Configure Segment Routing —IS-IS v4 Node SID

## Configuring Segment Routing

### Before you begin

Before configuring IS-IS to support segment routing you must first configure the segment routing feature in global configuration mode.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. `segment-routing mpls`
4. `connected-prefix-sid-map`
5. `address-family ipv4`
6. `1.1.1.1/32 index 100 range 1`
7. `exit-address-family`

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Device# enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
Step 3	<code>segment-routing mpls</code> <b>Example:</b> Device(config-sr)# segment-routing mpls	Enables the segment feature using the mpls data plane.

	Command or Action	Purpose
<b>Step 4</b>	connected-prefix-sid-map <b>Example:</b>  Device(config-srmppls)# connected-prefix-sid-map	Enters a sub-mode where you can configure address-family specific mappings for local prefixes and SIDs.
<b>Step 5</b>	address-family ipv4 <b>Example:</b>  Device(config-srmppls-conn)# address-family ipv4	Specifies IPv4 address prefixes.
<b>Step 6</b>	1.1.1.1/32 index 100 range 1 <b>Example:</b>  Device(config-srmppls-conn-af)# 1.1.1.1/32 100 range 1	Associates SID 100 with the address 1.1.1.1/32.
<b>Step 7</b>	exit-address-family <b>Example:</b>  Device(config-srmppls-conn-af)# exit-address-family	Exits the address family.

## Configuring Segment Routing on IS-IS Network

### Before you begin

Before you configure segment routing on IS-IS network, IS-IS must be enabled on your network.

### SUMMARY STEPS

1. router isis
2. net network-entity-title
3. metric-style wide
4. **segment-routing** mpls
5. exit
6. show isis segment-routing

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	router isis <b>Example:</b>  Device(config-router)# router isis	Enables the IS-IS routing protocol and enters router configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	net network-entity-title <b>Example:</b>  Device(config-router)# net 49.0000.0000.0003.00	Configures network entity titles (NETs) for the routing instance.
<b>Step 3</b>	metric-style wide <b>Example:</b>  Device(config-router)# metric-style wide	Configures the device to generate and accept only wide link metrics.
<b>Step 4</b>	segment-routing mpls <b>Example:</b>  Device(config-router)# segment-routing mpls	Configures segment routing operation state.
<b>Step 5</b>	exit <b>Example:</b>  Device(config-router)# exit	Exits segment routing mode and returns to the configuration terminal mode.
<b>Step 6</b>	show isis segment-routing <b>Example:</b>  Device# show is-is segment-routing	Displays the current state of the IS-IS segment routing.

### Example

The following example displays output from the show isis segment-routing state command for the segment routing under IS-IS:

```
Device# show isis segment-routing

ISIS protocol is registered with MFI
ISIS MFI Client ID:0x63
Tag 1 - Segment-Routing:
  SR State:SR_ENABLED
  Number of SRGB:1
  SRGB Start:16000, Range:8000, srgb_handle:0x4500AED0, srgb_state: created
  Address-family IPv4 unicast SR is configured
  Operational state:Enabled
```

## Configuring Prefix-SID for IS-IS

This task explains how to configure prefix segment identifier (SID) index under each interface.

### Before you begin

Segment routing must be enabled on the corresponding address family.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. segment-routing mpls
4. connected-prefix-sid-map
5. address-family ipv4
6. 1.1.1.1/32 index 100 range 1
7. exit

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	enable <b>Example:</b>  Device# enable	Enables privileged EXEC mode.
<b>Step 2</b>	configure terminal <b>Example:</b>  Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	segment-routing mpls <b>Example:</b>  Device(config)# segment-routing mpls	Configures segment routing mpls mode.
<b>Step 4</b>	connected-prefix-sid-map <b>Example:</b>  Device(config-srmppls)# connected-prefix-sid-map	Enters a sub-mode where you can configure address-family specific mappings for local prefixes and SIDs.
<b>Step 5</b>	address-family ipv4 <b>Example:</b>  Device(config-srmppls-conn)# address-family ipv4	Specifies the IPv4 address family and enters router address family configuration mode.
<b>Step 6</b>	1.1.1.1/32 index 100 range 1 <b>Example:</b>  Device(config-srmppls-conn-af)# 1.1.1.1/32 100 range 1	Associates SID 100 with the address 1.1.1.1/32.
<b>Step 7</b>	exit <b>Example:</b>  Device(config-router)# exit	Exits segment routing mode and returns to the configuration terminal mode.

## Configuring Prefix Attribute N-flag-clear

By default, a flag called N-flag is set by IS-IS when advertising a SID which is associated with a loopback address. If you wish to clear this flag add explicit configuration.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. interface loopback3
4. isis prefix n-flag-clear

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Device# enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	interface loopback3 <b>Example:</b> Device(config)# interface loopback3	Specifies the interface loopback.
<b>Step 4</b>	isis prefix n-flag-clear <b>Example:</b> Device(config-if)# isis prefix n-flag-clear	Clears the prefix N-flag.

## Configuring Explicit Null Attribute

To disable penultimate-hop-popping (PHP) and add explicit-Null label, explicit-null option needs to be specified. Once the option is given, IS-IS sets the E flag in the prefix-SID sub TLV.

By default, a flag called E-flag (Explicit-Null flag) is set to 0 by ISIS when advertising a Prefix SID which is associated with a loopback address. If you wish to set this flag add explicit configuration.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. segment-routing mpls

4. set-attributes
5. address-family ipv4
6. explicit-null
7. exit-address-family

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Device# enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	segment-routing mpls <b>Example:</b> Device(config)# segment-routing mpls	Configures segment routing mpls mode.
<b>Step 4</b>	set-attributes <b>Example:</b> Device(config-srmpls)# set-attributes	Sets the attribute.
<b>Step 5</b>	address-family ipv4 <b>Example:</b> Device(config-srmpls-attr)# address-family ipv4	Specifies the IPv4 address family and enters router address family configuration mode.
<b>Step 6</b>	explicit-null <b>Example:</b> Device(config-srmpls-attr-af)# explicit-null	Specifies the explicit-null.
<b>Step 7</b>	exit-address-family <b>Example:</b> Device(config-srmpls-attr-af)# exit-address-family	Exits the address family.

# Configuration Examples for Segment Routing —IS-IS v4 Node SID

## Example: Configuring Segment Routing on IS-IS Network

The following example shows how to configure prefix segment identifier (SID) index under each interface:

```
Device(config)#segment-routing mpls
Device(config-srmppls)#connected-prefix-sid-map
Device(config-srmppls-conn)#address-family ipv4
Device(config-srmppls-conn-af)#10.1.2.2/32 index 2 range 1
Device(config-srmppls-conn-af)#exit-address-family
Device(config-srmppls-conn-af)#end
```

## Example: Configuring Explicit Null Attribute

The following is an example for configuring explicit null attribute:

```
Device(config)# segment-routing mpls
Device(config-srmppls)# set-attributes
Device(config-srmppls-attr)# address-family ipv4
Device(config-srmppls-attr-af)# explicit-null
Device (config-srmppls-attr-af)# exit-address-family
```

## Additional References for Segment Routing-IS-IS v4 Node SID

### Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases <a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mcl/allreleasemcl/all-book.html">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mcl/allreleasemcl/all-book.html</a>
IP Routing ISIS commands	Cisco IOS IP Routing ISIS commands <a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mcl/allreleasemcl/all-book.html">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mcl/allreleasemcl/all-book.html</a>



**Technical Assistance**

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

## Feature Information for Segment Routing—IS-IS v4 Node SID

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 1: Feature Information for Segment Routing—IS-IS v4 Node SID**

Feature Name	Releases	Feature Information
Segment Routing—IS-IS v4 Node SID	Cisco IOS XE Release 3.16S Cisco IOS XE Fuji 16.7.1	The Segment Routing—ISIS v4 node SID feature provides support for segment routing on IS-IS networks.  The following commands were introduced or modified: <b>connected-prefix-sid-map, show isis segment-routing, isis prefix n-flag-clear, explicit-null</b>  In Cisco IOS XE Fuji 16.7.1, this feature is supported on Cisco 4000 Series Integrated Service Routers.

